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ABSTRACT

This position paper describes Indiana's research goals and efforts to develop a student-centered, industry-referenced approach to performance based vocational education (PBVE) programs and curricula. The introductory section traces the state's efforts to establish priorities and systematically develop performance based programs and describes research efforts, involvement in the Vocational-Technical Education Consortium of States (V-TECS), the work of a curriculum specialists consortium, and the resulting Indiana PBVE Management System. The remainder of this booklet consists of two chapters which focus on the research subsystem of Indiana's PBVE Management System. Chapter 1 describes research efforts to strengthen the link between education and work and covers creating the link, definition of terms, manpower needs, individual student needs (secondary and postsecondary), program articulation needs, and accountability. The second chapter specifies the state's plan for developing multi-occupational PBVE programs, using auto mechanics as an example of how this process works. The content includes developing a program management plan, structuring a program, deriving course content, administering multi-occupational PBVE, and conducting systematic follow-ups of graduates. The appendixes contain the matrix for auto mechanics job titles, a multi-occupational PBVE program worksheet, a task analysis guide and content limits identification worksheet, and estimated equipment lists for engine systems. (EM)

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Number Five

A Position Paper

RESEARCH FOR PERFORMANCE BASED VOCATIONAL EDUCATION IN INDIANA

written by

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ABSTRACT

This position paper describes Indiana's research goals and efforts to develop a student-centered, industry-referenced approach to performance based vocational education (PBVE) programs and curricula.

The paper begins with an introduction, written by Indiana's state coordinator of supportive services and program improvement, which traces the state's efforts to establish priorities and to develop performance based programs in a systematic, comprehensive way. It describes research efforts, involvement in V'TECS, the work of a curriculum specialists consortium, and the resulting Indiana PBVE Management System.

The position paper itself, written by the state's V'TECS coordinator, focuses on the research subsystem of Indiana's PBVE Management System. It outlines many of the processes involved in this research subsystem, describing research efforts to strengthen the link between education and work and specifying details of the state's plan for developing multi-occupational PBVE programs. This includes a process plan for organizing programs and deriving curriculum content. It is based on analysis of job titles and tasks and on the development of a job title matrix.

Figures and appendices include: Indiana's PBVE Management System, the basic matrix, the applied matrix for auto mechanics job titles, and various guide sheets to illustrate processes used in developing PBVE programs.

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E.E.H.

INTRODUCTION

Background

The pressures on vocational education to be more accountable for its activities are steadily mounting. Demands for open-entry, open-exit, job related vocational programs have been voiced at public hearings in Indiana. Taxpayers, through their elected representatives at all levels, are demanding evidence that the dollars expended for buildings, laboratories, equipment, supplies, and salaries are yielding acceptable returns. Education is no longer in the sacred position to receive public permission to "do more at all costs"; instead people want to know who can do it best and how it can be done at the least expense. These public expectations have imposed a greater responsibility for establishing a cost-effective system for vocational education upon state boards of vocational-technical education and other high-level decision makers.

The State Board of Vocational and Technical Education in Indiana has recognized and accepted this challenge and has taken initial steps toward establishing a system that will provide solutions to complex management problems. These steps include research, development, and implementation activities which have provided a rationale and data base upon which to predicate future efforts. These activities demonstrate the state's commitment to a cohesive, systematic approach and its resolve to sustain an ongoing effort toward improved programs, more efficient management, and accountability.

State Established Priorities

In November, 1975, a survey of vocational administrators in Indiana was conducted to determine their priorities for Part C, Research and Part D, Exemplary Projects (Hornback, 1975). The results of this survey showed their priorities to be as follows:

Priority 1: Curriculum development based upon specific job titles and job task analysis.

Priority 2: Statistically verified research of specific job titles including tabulated job tasks and written task analyses.

Priority 3: Development of a model vocational education program based upon a job title and task analysis curriculum plan.

After reviewing these data with the State Research Advisory Committee and a State Curriculum Advisory Committee, it was determined that top priority should be given to job title analysis and curriculum development research which could be used ultimately for program planning. This suggestion was presented to the state board which passed the following resolution in August, 1975:

> The State Board of Vocational and Technical Education, State of Indiana, philosophically and financially supports development of vocational education curricula resultant from the identification, prioritization, and analysis of job titles.

Indiana's State Plan for Vocational-Technical Education also supports this resolution (State of Indiana, 1978). In keeping with the state's commitment to job title curriculum research and development, the state board passed Resolution 11-4, approving Indiana's membership in the Vocational-Technical Education Consortium of States (V-TECS).

Indiana Efforts to Achieve Performance Based Vocational Education (PBVE)

Early Research Efforts

In the past several years, Indiana has been stepping up its research efforts in performance based vocational education (PBVE). In 1974 the state board funded Project HOPE (Health Occupations Professions Education) in the allied health area. One of the main thrusts of this project was to develop a performance based student training model. During the first year of the project a program organization and content derivation matrix was structured and task inventories for 87 job titles were developed. This occupational matrix was a process plan which clustered job titles in such a manner that tasks and learning content were organized according to their commonalities so that job titles could be taught in more efficient clusters. In 1976 curriculum module prototypes were developed and field tested. Much of the developmental process used in the 1976 efforts of Project HOPE was

modeled from a paper by West and Frantz (1976) called, "A Program Organization and Content Derivation Procedure for a Performance Based, Multi-occupational Approach to Vocational Education."

In 1975, the state board funded another curriculum research project designed to study the application of the PBVE concept in the domain of auto mechanics (used here in its generic sense). This project included a matrix-building process, similar to the one used in Project HOPE, which analyzed occupations and organized them into clusters so that multi-occupational PBVE programs could be developed and implemented.

In both projects the following things were accomplished that would further the PBVE effort in Indiana.

1. Each vocational area was surveyed to determine its job titles in Indiana.

2. Each vocational area was analyzed and an occupational matrix developed that would facilitate program and curriculum development.

3. Task inventories were developed for 87 job titles in the allied health field and for ten of the job titles in the auto mechanics field.

4. Prototype learning modules and program structures were generated.

Vocational-Technical Education Consortium of States (V-TECS)

A performance based system for vocational education requires a data base. After completing two projects designed to generate a data base, it was determined that the most cost effective way to secure this information was through cooperative efforts with other states. In 1975 the V-TECS system was investigated and the decision made that Indiana would become a consortium member. Since that time, Indiana has been assigned the development of domain catalogs in agrichemicals, mechanical drafting, and accounting.

Indiana's V-TECS research effort has gone beyond the requirements of the V-TECS memorandum of agreement. Indiana's total PBVE system requires that an occupational matrix similar to those for auto mechanics and allied health be developed. In addition to this, Indiana's V-TECS Dissemination Plan was designed as a segment of the total state PBVE dissemination/diffusion plan which promotes and introduces these materials to state

educators. Users of the V-TECS materials are provided individualized inservice training programs prior to receiving the materials.

Recent PBVE Research and Development

Since 1976 several PBVE projects have been funded by the state board. One funded project in distributive education (Devitt & Leonard, 1977) was designed to compare and interface the Lucy Crawford study (1969) with the V-TECS Cashier-Checker catalog and to identify student job title goals in the field of distribution. Other projects in business and office education and agribusiness education have been funded to develop a program organization and learning content derivation matrix for each field.

The state has received a United States Office of Education grant, for a project entitled "Assessment of an Individual's Job Related Skills and Knowledges" (1976, number G007603815), which has enabled Indiana to develop a model domain referenced test (DRT) using the research data from V-TECS to identify test items. Thirteen pilot schools have implemented the state board's PBVE process in one of five program areas so that their teachers can develop and field test DRT's with a single data and organizational base. The teachers and administrators involved in the development of DRT's find that it is an enormous task. Indiana state vocational administrators are recommending that interstate cooperation for this purpose should be explored since it would conserve these efforts as well as vocational education monies.

Curriculum Specialists Consortium

Indiana vocational administrators have recognized that the transition from experience based to performance based programs in vocational education calls for a systematic approach to resource utilization and planning, and that it requires the involvement of university and state administration personnel from all vocational program areas. A consortium of curriculum specialists from these two groups was formed in 1976 to study PBVE and V-TECS and to design a system for coordinating those groups responsible for making PBVE a reality in Indiana.

The Curriculum Specialists Consortium has developed a management system for PBVE programs. In an extensive search for information and materials, the consortium reviewed the literature and studied management systems of other states. It found a wide range in the quality of available materials/media and an even wider range in the formality of states' efforts to systematically implement PBVE.

In general, despite the increased interest in PBVE, the consortium's findings suggest "there is less in this than meets the eye," especially in terms of states' efforts to implement PBVE programs. Although several states are producing excellent performance/competency based materials and some are making significant efforts to implement performance/competency based programs, most states have no comprehensive management plan to prioritize, develop, and implement performance/competency based programs. That is, the consortium was able to find few comprehensive state plans or systems which identify the steps necessary for efficient and effective management and which specify functions for all vocational education providers.

The consortium set a goal to develop a performance based vocational education system for Indiana. In order to accomplish this goal, the consortium found that it needed baseline information and an organization scheme so that they might plan effective/efficient management and coordination of PBVE program development. Therefore, it began by laying this kind of foundation for its job. The first effort was to develop a list of terms which are defined as they are commonly used in PBVE planning (included at the end of this report in the Glossary); the second was to develop the broad outlines of a PBVE Management System for Indiana. The outline for this system is visualized in Figure 1.

Indiana's PBVE Management System

This PBVE Management System represents Indiana's ongoing effort to improve vocational programs in an efficient and effective manner. The PBVE system which is being planned will have three interactive components, each with interactive subsystems. In other words, the design, development, implementation, and evaluation steps in each subsystem will be responsive to operational actions in all others.

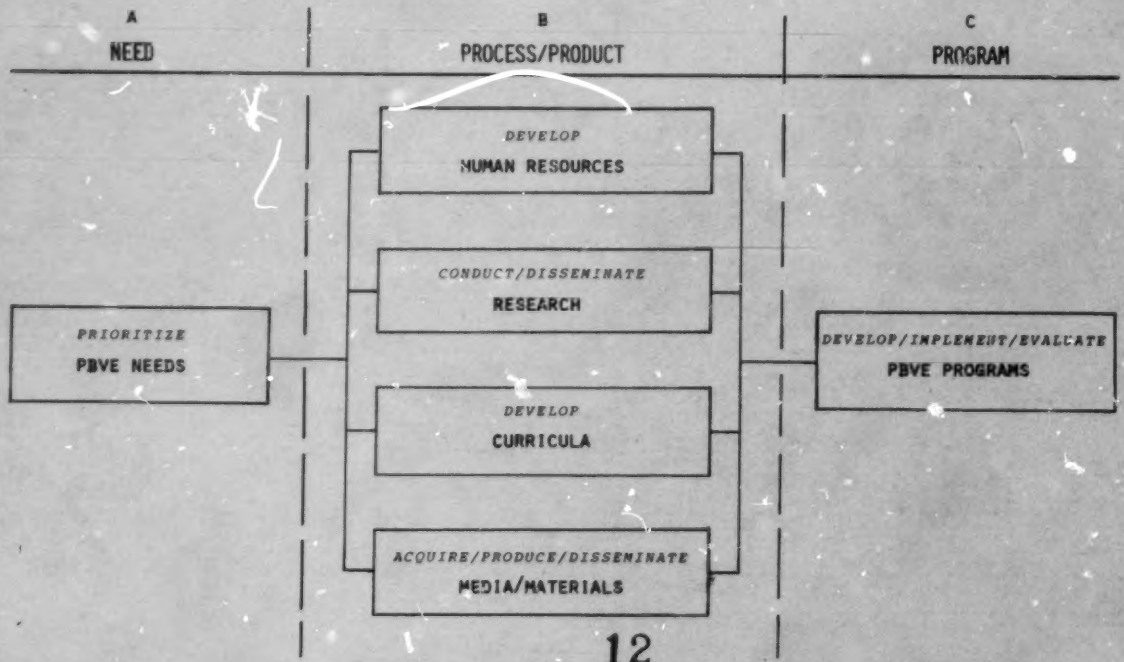
As the outline for this system is further developed, details of its processes will be filled in and more fully described. This report is the first in a series of position papers which will describe the subsystems of the state's PBVE Management System. It focuses attention on the research subsystem of the Process/Product component (see Figure 1).

Research Subsystem

The objectives and activities of the research subsystem are:

1. Define research objectives.

FIGURE 1: INDIANA'S PERFORMANCE BASED VOCATIONAL EDUCATION (PBVE) MANAGEMENT SYSTEM



2. Identify research problems and needs.

3. Plan scope and sequence of research.

4. Identify groups/persons providing and using research.

5. Establish priorities and time schedules for implementing research activities.

6. Identify linkages between itself and other subsystems in the PBVE Management System.

7. Receive inputs from other subsystems (data, materials, media, etc.).

8. Implement and evaluate research (formative).

9. Provide research data and materials to other subsystems.

10. Evaluate research subsystems (summative).

The position paper by Bill West which follows describes many of the processes involved in the research subsystem of the Indiana PBVE Management System. The paper outlines the linkage between education and work and describes the state's plan for developing multi-occupational PBVE programs. Further information about this research subsystem of the state's management system can be procured through the Vocational Education Information Services (see page iv).

E.E.H.

CHAPTER I

RESEARCH TO LINK EDUCATION AND WORK

Creating the Link

Today most segments of America's skilled and professional work force are experiencing severe criticism from the consuming public. The quality of workmanship is frequently considered to be poor and the product or service incongruously expensive. When the public searches for someone to blame for this imbalance between quality and cost, it looks to the publicly supported producers of today's work force, of which one is education--specifically secondary and postsecondary vocational education. Vocational education should accept its share of the reproach and its share of the responsibility for correcting the situation.

It can best fulfill this responsibility by creating a link between education and industry. To do this, a research effort is needed to identify the needs and practices of industry so that effective research and development can be done in the areas of program modification and curriculum development. Vocational programs and corresponding curricula must be structured to be sensitive both to industry's needs and student-clients' career aspirations. In addition, it is not enough to prepare students to fill job vacancies at the technical level at which they now exist. It should be the purpose of education to prepare the prospective job holders to be technically better than present employees so that they can help improve the quality of services and products.

This describes the long-range goal of vocational education in Indiana. This position paper will share the results of many hours devoted to discussion and research to develop what Indiana considers to be a client-centered, industry-referenced approach to performance based vocational education (PBVE) programs. A plan for program organization and curriculum content derivation will be presented and discussed. Although some small trial runs have been conducted and found to be satisfactory, this process has not been fully tested and refined. It is hoped that this presentation will stimulate further thought and action which will make vocational programming even more sensitive to needs of students and industry, and more accountable to the consuming public.

Definition of Terms

In an area which has yet to become a science words must be defined to avoid misunderstandings. Education in general and vocational education in particular lack a common contextual base for technical terms. To help explain the use of terms in this report, the following list of expanded definitions is provided, in addition to the basic list of commonly used definitions in the Glossary.

Auto mechanics A generic term for the auto, light duty, and medium duty vehicle repair industry under which are subsumed the 45 job titles identified in an Indiana research project (West & Brannock, 1978). This group of job titles is technically in the highway transportation subcluster of the transportation occupations cluster.

Curriculum management plan A systematic collection of documents which sufficiently specifies curriculum content, its organization for classroom implementation, and the assessment instruments and methodologies for pre- and post-instruction evaluation of learners.

Domain A set or class of knowledges, skills, and understandings where the essential attributes of the content which the student is expected to acquire and the behavior through which he or she is expected to demonstrate such acquisition are carefully described (Baker, 1974). This concept involves a scheme for classifying the knowledges and skills which make up specific tasks and the collections of specific tasks which make up a duty area. For this paper, the domain is identified and grouped into subdomains for further analysis and rules established for test item writing. A domain is a careful specification of the learning content which students are to acquire and the behaviors through which they are to demonstrate acquisition.

Domain referenced test (DRT) A test comprised of a random or stratified random sample of items representing a defined set, class, or universe of tasks (domain). The test is considered to be a sample from an exhaustive set of all possible things that a student can do to demonstrate acquisition of certain concepts, principles, abilities, or skills. The test items on a specific DRT must be representative of the entire domain. The DRT score is considered to be an unbiased estimate of the student's score for the particular domain.

Duty A grouping of related tasks derived through job analysis. The tasks are related by the generalizable cognitive and psychomotor skills embedded in them. These generalizable skills and the subsequent transfer of knowledge among tasks in a duty area facilitate the establishment of DRT's. For the purposes of this paper, the duty area is similar to a content domain.

Multi-occupational PBVE program A vocational program structured so that the job titles actually existing in the industry are classified in such a way that the student can prepare for a single job title or a cluster of job titles in a single laboratory. The program is efficient because it identifies common cores of tasks and learning content at various levels of job title groupings. Student evaluation, advancement, and crediting/certification is based upon student demonstration of tasks.

Program management plan A collection of documents establishing the goal and scope of the program. It contains:

1. The scope of the program in terms of the occupational domains for which training will be provided.
2. Identified job titles within each occupational domain for which training will be provided.
3. An articulation procedure between secondary/postsecondary.
4. Program and/or course entry-exit points for both secondary and postsecondary levels.
5. Program goals stated in measurable terms.
6. Procedures for student assessment, advancement, and crediting/certification.
7. Bases for assigning students to programs.

Task An activity comprised of certain stimulus and response elements, the results of which are either directly observable or indirectly inferrable. A task must possess six defining attributes (West, 1976).

1. A task has a definite beginning and end.
2. A task is an inherent part of a job.
3. A task is done in a relatively short period of time.
4. A task is amenable to testing in a real-life situation.
5. A task is composed of subtasks which are capable of sequencing into a terminal performance.
6. A task is the smallest bit of meaningful activity that is done for its own sake when viewed in relation to the total array of job activities performed by the job holder.

Task analysis A process of reducing a task into its affective, cognitive, and psychomotor behavioral components. It identifies task elements which are generalizable to other tasks within a class or among tasks of different classes within a duty domain. This analytical process produces a definitive list of task-specific and generalizable skills and knowledges and

derives possible learning sequences (West, 1976). Although the process is described in verbal terms it is similar to Durnin and Scandura's (1973) algorithmic model.

Manpower Needs

The manpower needs of industry are varied and complex. A reasonable way for vocational educators to begin meeting these needs is by determining which jobs actually exist in the industries for which their program areas are preparing future employees. It is often believed that industry wants an employee who knows *something* about *everything* in a given field. But, in fact, that *something* has not been consensually identified or verified. As a consequence, educational programs have often been based on the instructor's expertise, which is usually limited to one area of a larger field, or on the counsels of a local advisory committee whose collective expertise is also limited by its combined background experience.

Recent Indiana research indicates that industry not only wants an employee who has sufficiently broad background in a given field, such as auto mechanics, but also one who has depth enough to function in a job title with little or no retraining. To meet this need it was necessary to identify the job titles in an occupational area in a community, to identify and teach the tasks, and to teach the theory associated with each task so as to insure performance transfer. The program management plan presented in this paper is designed to provide for both breadth and depth of training while accommodating varying student career goals.

Individual Needs

Students who enroll in occupational education programs do so for a variety of reasons and, therefore, have different goals to accomplish at both the secondary and postsecondary levels. The following examples illustrate this point.

Secondary

1. Some students enroll out of frustration with the rest of education. For them, vocational education has a negative appeal: there is no place better to go. However, these students are not goalless; their immediate goal is to escape to the lesser of two evils.

2. For some learners the goal is avocational. Even though this is not the primary goal for vocational education programs, these students who enroll for this reason can not be excluded.

3. Some students are ready to make a broad, long-range career decision and to set their educational goals accordingly. This can be a tentative or flexible decision rather than a permanent one. These students might choose to spend two or three hours daily for an extended period of time studying a clustered group of related occupations, such as those found in job titles dealing with engine system repair. But, individual students in this group have individual goals to be satisfied within the engine systems cluster.

4. Other students have narrower, short-range goals. They might have specific occupations in mind for which they want to prepare because they desire salable skills for immediate, supplemental, or part-time employment. Persons in this group have goals which are diversified and individual, and preparation for a single job at whatever level is vocational education to students who need it.

5. Some students who enroll do not really know their vocational goals but feel a need to explore. Whereas, more effective career exploration programs might help alleviate this problem, these students actually enroll in vocational education classes every year; so vocational education must meet their needs.

Postsecondary

1. Some students have left school as graduates or dropouts and still have need for training to secure immediate employment. Their need is not for a one or two year training program but for training that can be converted into employment and a pay check as soon as possible.

2. Others who are enrolled in full vocational training must interrupt their programs in order to secure a job because tuition money has been exhausted. They need an immediate exit point, fully trained to function in a job title.

3. Some students are studying to upgrade themselves for a different job title. They are specific in their training need and have no desire to study unessentials or to repeat training for tasks they can perform.

4. Often industry enrolls personnel in night classes in postsecondary institutions to train employees for specific job titles. They, too, are job title specific.

5. Most postsecondary students wish to pursue career goals. They are sophisticated and do not wish to waste time studying things which have doubtful value for the job. They wish to achieve their career goals as soon as possible and to enter the world of work.

In summary there are three basic realities which theory and practice teach us that vocational education planners must consider:

1. Vocational education courses will continue to enroll students who have diverse career goals.

2. Vocational education students possess a wide range of learning strengths and abilities.

3. Enrollees will enter courses with a wide variety of previous learning experiences and motivations which affect the duration and the nature of their training.

In view of these realities, programs should allow learners' goals, objectives, and time requirements to vary within and among occupational clusters. However, it is often true that traditional vocational programs organize their time schedules into blocks and their learning content into inflexible courses which do not accommodate individual needs. Therefore, one of the thrusts in Indiana's effort is to develop program management plans for multi-occupational, performance based vocational education (PBVE) programs which will allow for greater flexibility in vocational education programming and more nearly meet the individual goals and needs of students.

This position paper presents a plan for developing multi-occupational PBVE programs that provide individuals with the skills, knowledges, and attitudes required for entry into a cluster of occupations. According to this plan, students might receive training for one job title or for several related job titles or in-depth specialization in a single, specific job title.

The administrative plan for program organization in the recommended PBVE approach is designed to provide students with multiple options when they make their career decisions and with a flexible program which can meet their individual needs. Students have three options:

1. They can prepare for entry into a single, entry-level job.

2. They can prepare for entry into several related job titles that have some common competencies but do not require sequential preparation.

3. They can specialize in one category of jobs within the cluster or prepare for thorough specialization in one high level job title.

For example, students might enter the auto mechanics program to prepare for the single job of tune-up specialist. Students would proceed through the program, accomplishing the tasks specified for that job until all required tasks were mastered, then they could exit the program. They might do this in varied and, perhaps, relatively short periods of time.

The recommended plan is designed to accommodate students who choose comprehensive programs to prepare themselves not only for several kinds of jobs within the subcluster but also for entrance into the world of work at a higher level with possibilities for rapid advancement. These students would spend a much longer time in preparation for such a complex occupational goal.

Program Articulation Needs

One of the most frequently heard complaints from students who transfer to a vocational program at a different secondary school or from students who are beginning study at the postsecondary level is that they have studied the material before. Among the causes for this problem are these:

1. A breakdown in communications between schools and programs because their concepts and terminology do not mean the same thing.

2. The inability to objectively or concretely communicate course content between programs because these programs have no common learning content data base upon which they have agreed.

3. The inability to provide continuity for specific career preparation between programs.

4. The lack of a learning content data base which is referenced in industry.

Each of these causes serves as a roadblock for students to be appropriately placed in a new program; thus, transferring students are started at or near the beginning regardless of their skills. The result is wasted time, effort, and money; students become bored and lose respect for the educational process.

The plan proposed in this position paper is designed to

alleviate the problem by providing a program format, referenced in industry, which will permit students to (1) choose career goals at any educational level, (2) transfer to higher levels without loss of preparation time due to repetition, (3) change their career goals with a minimum loss of training time, and (4) exit the program after demonstrating the competencies required to successfully function in the chosen job title or cluster of job titles.

This vertical and horizontal flexibility makes programs less costly to the schools and students alike. According to this plan, students could begin, and possibly complete, a career objective at any level or transfer between levels with little or no loss of training time. Certification in a given job title or cluster of job titles could even be a joint venture.

Cost-Effectiveness and Accountability

The organization of a multi-occupational PBVE program is aimed at providing options for students as they pursue vocational careers while providing an administrative system that is efficient in time, energy, and dollars. Traditionally, vocational education has been offered to students in three-hour blocks of time with each quarter or semester being a prerequisite to the next. These courses have usually suggested a maximum enrollment of 20 students. The assumption has been that all 20 students have the same educational-occupational goals, learning configurations, and career choices. Since most other vocational programs have been similarly structured, most students have been forced to remain in a program for a year, long after the decision that the program was either not for them or that their needs were not being met. Administratively, this meant that a lab was used by one teacher for three hours serving 20 students for an entire school year.

A multi-occupational PBVE approach would structure vocational programs so that each student could accomplish his goals in the least possible length of time. If students were to spend time in the program commensurate with their occupational goals and if new students filled the vacated places in a program as other students completed their work, programs would meet more students' needs in a single lab with a single teacher in a year.

Furthermore, programs could be more accountable. If each program management plan were to specify job titles for which training would be provided and if each job title were defined in terms of tasks performed by the employee, then it would be easier to account for accomplished training goals.

CHAPTER II

MULTI-OCCUPATIONAL PBVE PROGRAMS

Developing a Program Management Plan

Before attempting to develop a curriculum and implement a vocational program, it is necessary to identify the training target. The target which has been set for Indiana is the preparation of each individual for a single job title or a cluster of related job titles using programs and curricula which are based on industry-verified job titles and tasks. This position paper will use auto mechanics as an example of how this process can work. Other management plans are being developed in Indiana for mechanical drafting, machine trades, horticulture, and secretarial areas.

Auto Mechanics Matrix

Development of a program management plan in auto mechanics must be preceded by an analysis of the occupational cluster. An occupational matrix is a useful tool for program management because it facilitates the decision making process in program organization and curriculum content derivation. A complete description and discussion of the matrix for auto mechanics is presented in report number four of this information series (West & Brannock, 1978).

The matrix is a scheme for classifying and grouping job titles for the purpose of curriculum development. It provides a process for analyzing actual occupations and organizing them into clusters so that multi-occupational PBVE can be developed and implemented. This matrix plan is designed to provide (1) a data base and a system for administratively structuring multi-occupational PBVE programs and (2) a process for deriving and organizing learning content for efficient instruction.

When the auto mechanics matrix was developed, the first step was to identify and label broad groupings of related job titles within the vehicle repair aspect of the highway transportation subcluster of the transportation occupations cluster. This information was arranged into an eight-component matrix (Figure 2). The first four of the eight components of the

FIGURE 2: THE BASIC MATRIX--A PROCESS PLAN FOR ANALYSIS OF JOB TITLES AND TASKS

PLAN FOR PROGRAM ORGANIZATION				DERIVATION OF LEARNING CONTENT			
I	II	III	IV	V	VI	VII	VIII
DIVISION	CATEGORY	SUBCATEGORY	JOB TITLE	TASK	SUBCATEGORY CORE	CATEGORY CORE	DIVISION CORE
Major groupings of job titles *similar to vocational programs*	Second-level groupings of job titles *similar to specific curricula*	First-level groupings of job titles *similar to course offerings*	List of all job titles *smallest administrative units of instruction*	List of tasks for each JOB TITLE (IV)	Tasks common to job titles in SUBCATEGORY (III)	Tasks common to job titles in CATEGORY (II)	Tasks common to job titles in DIVISION (I)

Note: The matrix plan produces an organizational base and a data base for multi-occupational performance based vocational education (PBVE) curriculum development. It provides a process for organizing programs and for deriving learning content.

matrix offer a basic classification scheme which provides for:

1. Administrative flexibility, feasibility, and viability.
2. Open-endedness to add new or emerging occupations.
3. Grouping of job titles by tasks performed and job skills required.
4. Grouping of job titles by place of performance.
5. Task identification by job title.
6. Core competency identification.
7. Assignment of job titles to mutually exclusive categories.

The second four of the eight matrix components were based on information derived from a task inventory of industry which identified job titles and their relationships. These survey results were used to assign learning content of the curriculum to cores which correspond to the division, category, and subcategory clusters of job titles, based on common tasks performed by job holders (Figure 2). The matrix plan is designed to help develop PBVE training program planning at the secondary and postsecondary (not baccalaureate) levels which correspond to actual job titles and tasks in business and industry. The complete auto mechanics matrix is presented in Appendix A.

Program Organization with the Auto Mechanics Matrix

Industry referenced job titles and tasks form the basis of the multi-occupational PBVE program recommended in this paper. In such a program students could enter a program and prepare for a specific job title or cluster of job titles by learning the content necessary to perform the tasks to industry standards. The students would demonstrate that they have mastered the content by performing the tasks.

When administratively structuring a program management plan the first step is to identify broad programs. Other components which must be defined so an administrative operational system can be established are occupational categories or program curricula, course offerings, and job titles, which are the smallest administrative units of instruction. The LEA, through an advisory committee and/or a survey of the local employing area, determines the programs offered. For the details of this process, see the program management planning guide in Appendix B.

When this process was followed to develop the auto mechanics matrix, four occupational programs (matrix *divisions*) were identified:

A. Auto, light duty, and medium duty vehicle repair (henceforth called Passenger vehicle repair)
   1. Cars
   2. Pickup trucks (½-ton limit)
   3. Vans (½-ton limit)
B. Heavy duty vehicle repair
   1. Heavy vehicles (3/4-ton)
C. Truck and auto body repair
D. Small Engine repair
   1. Marine
   2. Motorcycle
   3. All-terrain vehicles
   4. Utility tools (e.g. lawn mowers, chain saws)

When step one of the program management planning guide (Appendix B) was followed, each of these programs was divided into occupational categories or curricula (matrix *category*) containing job titles closely related in terms of common (*core*) tasks performed by job holders or common (*core*) knowledges and skills needed to perform the tasks. The same three curricula were identified for both passenger vehicle repair and heavy duty repair programs. Because the small engine repair program reflects a smaller occupational group, the matrix has only six components, combining the matrix division and category components into one. See Appendix A for this and all subsequent references to the auto mechanics matrix. The curricula are as follows:

Programs (Divisions)	*Curricula (Occupational Categories)*
Passenger vehicle repair Heavy duty vehicle repair	Heavy line repair Light line repair Supportive occupations
Truck and auto body repair	Body and frame Trim and fabrics Preparation and painting Supportive occupations
Small engine repair	(no breakdown here)

The occupational categories or curricula are useful administrative units which could facilitate teacher assignment, student counseling, advisory committee structuring, and course structuring.

From step two of the planning guide, the courses which comprise each subprogram were identified as follows:

Curricula (Occupational Categories)	*Courses*
Heavy line repair	Engine system Drive train system
Light line repair	Brake system Front end system Electrical system Cooling system Fuel exhaust system
Supportive occupations	Supervisory Logistics and maintenance

If the LEA, because of enrollment demands or teacher limitations, chooses to combine courses, it is possible to do so. However, the cores provide the greatest amount of instructional efficiency, program flexibility, and training precision.

Step three used Indiana industry research to identify the job titles which would make up each course in the program. It should be noted that the term *specialist* is used in job titles throughout this paper in order to avoid sex stereotyping, even though the term is somewhat misleading and inaccurate. It is assumed that to be properly called a *specialist* one must have time on the job.

Course	*Job titles*
Engine system	Engine overhaul specialist Short block specialist Valve train specialist Automotive machinist Engine machinist Heavy line mechanic Lubrication systems specialist
Drive train system	Overdrive specialist Differential specialist Manual transmission specialist Automatic transmission specialist Clutch specialist Transaxle specialist Drive shaft repair specialist

Course	*Job titles*
Brake system	Hydraulic brake specialist Brake shoe reliner Pneumatic air brake specialist Brake machinist Light line mechanic
Front end system	Front end specialist Wheel bearings, tire & wheel balancing specialist Steering & suspension specialist
Electrical system	Engine diagnostic specialist Engine tune-up specialist Battery-generator-starter-alternator-regulator specialist Electrical wiring harness & diagram specialist Power accessory specialist
Heating and air conditioning system	Air conditioning service person Air cond. compressor overhauler Climate control specialist Air cond. diagnostic specialist Air conditioning installer Heater diagnostic specialist Heater core repairer
Cooling system	Cooling system specialist Core repairer
Fuel-exhaust system	Emission control specialist Exhaust system installer Fuel and air system specialist
Supervisory occupations	Shop foreman Service manager Quality control inspector Estimator Parts manager
Logistical and maintenance occupations	Lubrication person Dispatcher Car jockey or clean-up Service writer Parts & accessory salesperson Service salesperson Parts person

After an LEA has completed steps one, two, and three of the program management planning guide (Appendix B), it has planned the administrative organization of a PBVE program in terms of its occupational programs, courses, and job titles. It should be noted that the program's specifics are locally determined, and that courses can be combined to meet local needs. The matrix is simply a decision making tool which groups job title and task data into learning cores so as to facilitate the administrative structuring of programs that are efficient, flexible, and precise.

Deriving Course Content with the Auto Mechanics Matrix

The next two steps in program management planning enable LEAs to derive course learning content for their PBVE programs.

Analyzing Tasks and Setting Content Limits

Learning content is the cognitive and psychomotor knowledge and skills which a prospective employee must have in order to perform the tasks in a job title. These things which can be taught to the job title trainee are called *content limits* (Baker, 1974). The things which are interesting but not necessary to perform the job are kept out of the content limits.

Step four in the planning guide asks that content limits be set for each task, each group of related tasks (domain or duty area), each job title, each course, each curriculum, and each program. Step four identifies (1) transferrable core content at course, curriculum, and program levels, and (2) learning content which is unique to a particular job title. A sample task analysis guide is included in Appendix C along with a sample learning content limits identification worksheet. Notice that the content limits are in simple, straightforward language.

Task Analysis. Task analysis is simply a technique for interviewing employees to determine (1) steps they take and (2) decisions they make in the performance of a task. A complete discussion of task analysis for PBVE is presented in West (1976). Basically, tasks are grouped into domains based on hypothesized common learning content. Then each task is analyzed and the hypotheses corrected so that tasks are grouped in relation to one another according to their transferrable elements.

Task analysis can provide a basis for curriculum development and instructional design. The data produce:

1. A performance guide or operations sheet (task analysis guide) to be used by students as they practice doing the task after being taught what they must know to perform it.

2. A source for identifying learning content limits for each task. The content limits for each task in a duty category combine to become the content limits for a duty domain, and the content limits for all duty domains combine to equal the content limits for the job title.

3. A source of information for writing terminal objectives and enabling objectives (or *enroute obj.*, i.e., those which a student must achieve before attempting terminal obj.

4. A guide for sequencing instruction

5. A source for learning content from which domain referenced tests can be structured.

6. A guide for structuring learning modules.

7. A means of identifying the prerequisite capabilities the student must possess before attempting task performance.

Content Limits. Setting learning content limits involves examining each task element by asking what a person needs to know in order to perform it. The content includes facts, processes or procedures, verbal or motor chains, discriminations, concepts, or principles (rules). These items are then placed in one of four categories depending upon the extent of generalizability across the domain. If the content is cognitive and generalizable across all tasks in the domain, it is placed in group one. See Appendix C, Content Limits Identification Worksheet, column one. Group two contains the cognitive knowledges that are transferrable to tasks of a given class but *not* transferrable across the entire domain. Group three contains cognitive knowledges that are specific to a given task (e.g., overhaul a *Delco* regulator) and, consequently, not generalizable to other tasks (e.g., not to *Autolite* or *Essex* regulators). Groups four, five, and six categorize psychomotor skills in a like manner. The data which result help identify (1) content which is generalizable to the domain and, thereby, can be taught prior to the specific task content and (2) possible content for test item writing.

Related and Prerequisite Courses

The fifth step in developing a program management plan is to determine which generalizable content is ample enough to demand that prerequisite or related courses be established. The rationale for this is that it is more efficient to teach some of the generalizable learning content in a course(s) preceding the teaching of job title specific laboratory content. LEAs

must determine this organization in view of the cooperation and course offerings of sending schools, the sophistication of the students entering their programs, and their enrollment policies.

For example, depending upon the magnitude and generalizability of the learning content associated with the engine systems course, it might be advisable to require all beginning students with little or no previous training to enroll in an introductory course designed to teach the performance of simpler tasks common to all job titles in engine systems. The result should be greater administrative efficiency.

Task analysis might also identify a sufficiently large body of related learning such as math, science, English, first aid, or electronics to suggest that a related class be offered prior to or concurrent with a vocational course. However, it is important to insure that the prerequisite or related courses are designed to teach *only* that which is specified in the content limits. A full year of electronics would be unnecessary to prepare a learner to work with the primary and secondary electrical circuits of the automobile.

Administration of Multi-Occupational PBVE

After the program structure has been determined, there are several operational questions to be answered and administrative decisions to be made. For example:

1. In terms of contact hours, how long will a course be?
2. In terms of contact hours, what is the average expected training time for each job title?
3. At what point can students enter and exit a program or course?
4. How will students be assigned to courses? evaluated? advanced? credited or certified?
5. How will articulation between secondary and postsecondary programs occur?
6. What will be the maximum enrollment for each course?
7. What are the staff requirements for the PBVE program?
8. What are the equipment needs for the PBVE program?

Training Time

Step six establishes the training time needed for courses. The number of contact hours required would be dependent upon each student's career goal. Using this plan, students would see the en-

gine systems course, for example, in terms of their career goals, not as a rigid number of hours or years to spend in a program.

The average expected training time for each job title, and in some cases this would also comprise the course, would be determined by (1) the number of tasks to be mastered, (2)the estimated average learning rate of the target group, (3) prerequisite and/or related courses, and (4) equipment and space limitations. The estimated average training time for each job title could be used for (1) counseling students, (2) planning instructional sequences for the course, and (3) determining entry-exit points for students so that a constant enrollment level could be maintained.

Entry-Exit Points

Step seven in making a program management plan is to determine controlling points at which students can enter and leave a program or course. Entry into programs or courses can be controlled by at least three determinants:

1. A student could be required to first complete a prerequisite course satisfactorily or be currently enrolled in a related course.
2. The administrative blocking of time could determine entry points. If the school system were on a quarter basis, then the student could enter at any quarter break; but, if the school were on a semester basis, the student would enter at a semester break.
3. Students could be required to achieve a particular score on an entrance examination before entering a course or program, especially if they were entering postsecondary courses from the secondary level. If students failed to achieve the minimum score, they would be placed appropriately in the training sequence.

Leaving programs or courses can also be controlled by three basic determinants.

1. If the administrative crediting periods were on a quarter basis, students could exit a vocational course after nine weeks. If the accounting period were one semester in length the student would have to enroll in a course for eighteen weeks.
2. Job titles also determine exit points. If a job title had an estimated average training time of one quarter, students could exit the course at the end of the quarter provided they demonstrated the required competencies. The students would then have to select another one-quarter job title to satisfy the semester requirement if the school was on a semester system.

3. The students themselves determine exit points in that they must demonstrate competence; this could require an extra quarter or semester of training beyond the average. However, a person cannot be forced to stay in a course and might choose to exit at any administratively acceptable point with no passing grade, credit, or certification.

Assignment, Evaluation, Advancement, Crediting, and Articulation

Step eight determines for each training level (1) the number of students to be assigned, (2) how they will be assessed, (3) how they will be advanced, and (4) how they will receive credit or certification.

Assignment. Assignment is based on (1) completion of prerequisites or related courses, (2) attainment of a satisfactory score on an entrance examination, (3) a student's career goals, and (4) a student's background experience and training.

Evaluation. Student evaluation is based upon specific task performance to an industry-based standard and the individual's score on a test measuring the acquisition of the transferrable concepts and principles supporting task performance. In other words, students must: (1) respond to questions on a written or oral test of their grasp of the theory that is transferrable to other tasks in the domain and (2) perform a work sample to determine if they can perform the task, thus demonstrating their knowledge of theory. Assignment of grades for class work must be worked out by each teacher. However, articulation between secondary and postsecondary programs should be based on performance, not grades.

Advancement. Students advance in the program from one domain of tasks to another within a job title and from one job title to another within or between courses. For example, if Student A were training to be a short block specialist, and there were six domains of tasks to be completed, s/he could test out of each domain and advance. Then, if the same student were to choose to begin study on tasks specific to the engine machinist job title, s/he could be admitted because competence on transferrable knowledges and skills would have been demonstrated on the previous job title.

Credit or Certification. Credits are to be awarded to students on the basis of successfully completed job titles or partially completed job titles by quarter or semester. For example, if Student A were to enroll for a job title requiring one quarter's (135 contact hours) work and if the school system would permit, the student could be awarded 1½ Carnegie credits

upon completion of requirements. If the student were to choose a job title requiring one semester (270 hours), 3 Carnegie credits would be awarded when all the job title requirements were met.

If Student B were to opt for a job title requiring one year's (540 contact hours) preparation, credit would be awarded at the semester for the successful completion of teacher-determined and pre-announced domains.

According to this plan, student certification does not refer to a state agency certification for completion of cosmetologist, barber, or L.P.N. training, but, rather, to a written statement on a student profile or cumulative folder that a student has trained for a specific job title, and could perform a given list of tasks to a certain standard on that given date. This certification statement would be available for the student to take along when seeking employment and for the instructor to use in responding to inquiries.

Program Articulation. If institutions were to use common program referents of job title and task, articulation between programs at all secondary and postsecondary levels could be a rather straightforward process. The following examples demonstrate some ways this could work.

Example 1: Student A was attending Area School X and had chosen to prepare for the broad grouping of job titles in engine systems so as to become proficient as a short block specialist, engine overhaul specialist, and heavy line mechanic. After studying for one semester in Area School X, s/he had to transfer to Area School Y which also had a multi-occupational PBVE program in auto mechanics using the same data base and program structure. After taking a domain referenced test, s/he would be placed in the training cycle at an appropriate place leading to preparation in the same three job titles. There would be no need for repetitious training.

Example 2: Student B has been graduated from High School Z where s/he began a career goal in drive train systems and was certified by the secondary instructor as proficient as a manual transmission specialist and as having completed three domains of tasks for automatic transmission specialist. When enrolling at Postsecondary School Y in the drive train systems course, B would be given a domain referenced test which would validate the level of competence in the job title and three domains which s/he had completed. There would be no repetition of training if both training institutions used the same content data base and program structure.

Example 3: Student C has been graduated from high school with no training in auto mechanics but now has a goal to be an engine systems technician having the capability to perform

in each of the seven job titles shown. S/he would enroll in a postsecondary program and begin training. If s/he would move in nine months to another part of the state served by another postsecondary institution using the same auto mechanics data base and program structure, a domain referenced test would insure that s/he could avoid lost training time and receive the technical certificate in engine systems when s/he planned.

Example 4: Student D who has chosen to become a short block specialist, has learned and demonstrated competence in all the tasks, knowledges, and skills in the program core, subprogram core, and course core and must only yet learn to perform those tasks specific to the short block specialist. After doing this, s/he has an incentive to go on and become an engine overhaul specialist because s/he need only learn to do those tasks unique to this job title and not repeat those competencies in all the cores.

Example 5: Student E had chosen to become a valve train specialist and has completed all the required training, demonstrating competence in the tasks required. But, s/he hears of a good job as a transaxle specialist and enrolls at the local postsecondary program which is using the same data base and program structure as did the institution from which s/he received training. Because E has achieved the program and subprogram core tasks, s/he must study only course core and job title specific tasks before becoming eligible for certification as a transaxle specialist, thus sacrificing only the time spent studying engine systems core and valve train.

Maximum Enrollment Per Course

Step nine sets recommended enrollments for each course which will not usually differ much from state standards. For example, twenty students per teacher might be acceptable (labratory space and equipment availability permitting) in the engine systems course which concentrates only on the seven job titles shown. However, if job titles in drive train systems are offered as a part of engine systems because of an insufficient number of students to justify offering a drive train systems course, then the enrollment should be lowered to fifteen so that teachers can give the necessary attention to students learning such diverse content. This adjustment could also be made for teachers who lack expertise in some aspects of the course and who must have greater preparation time.

Staff Requirements

Step ten in the planning guide is to determine staff requirements which depend most basically on the enrollment and scope of the course offerings. If Area School X had suffi-

cient enrollment and student interest to offer each course in the passenger vehicle repair program, it would require a minimum of three instructors, one each for heavy line repair, light line repair, and supportive occupations. If the instructor for each curriculum lacked expertise in any course in this curriculum, inservice training in those areas of job title insufficiency would be necessary. If enrollments permitted, a better staffing arrangement would be an instructor for each course.

Another way to solve deficiencies in teaching expertise or equipment and space is to place students in cooperative programs. Using the task data base, the school can ask the employer to provide training in specific tasks.

Equipment Needs

Step eleven is to determine the equipment needs of all courses. Whereas specific job titles require special equipment, cored courses would allow for equipment sharing. The plan calls for specifying what is needed for each job title for each course and then identifying common equipment. The quantity of each item of equipment is then determined by estimating enrollment by job title and course. The equipment list shown in Appendix D is estimated for an engine systems course comprised of seven job titles.

Follow-up

According to the PBVE plan developed in Indiana, a systematic follow-up of program graduates should be conducted on a one-, two-, and five-year basis. The first year follow-up should be conducted to:

1. Determine if graduates are working in a job title for which they have been prepared.
2. Secure an evaluation of their school training.
3. Elicit suggestions for program improvement.
4. Promote good will and gain future program support.

The second year follow-up should be conducted to:

1. Determine degree of job mobility, vertically and horizontally, within the auto mechanics cluster.
2. Elicit suggestions for program improvement.
3. Promote good will and gain future program support.

The five year follow-up should be conducted to:

1. Trace career ladders in the auto mechanics cluster.
2. Elicit suggestions for program improvements.
3. Promote good will and gain program support.

The first year graduates should be personally contacted by the instructor, if possible. If the student has moved away, attempts to contact him/her by mail should be made. All of the first year graduates should be contacted. The second and fifth year graduates should be asked to respond to questionnaires.

Conclusion

The Indiana plan to conduct performance based vocational education research which has been presented in this position paper has not been fully developed or implemented. It is Indiana's long-range goal to pursue these plans further. There are many aspects of vocational education which have not yet begun to design their programs around job title clusters and task analyses.

For example, continuing education programs seem to be particularly suited to this concept because its students often have short-term, specific goals to learn job title tasks. With a flexible program management plan, continuing education students could enroll and exit a program at any time in a year. A performance based program which could provide them with skills necessary to a job title would be useful.

It is hoped that the plan for program organization and curriculum content derivation presented here will stimulate further discussion and activity so that the consuming public will recognize that vocational education has, indeed, accepted its share of the responsibility for providing an effective link between education and work.

APPENDIX A : THE MULTI-OCCUPATIONAL PBVE PROGRAM MATRIX FOR THE AUTO MECHANICS CLUSTER OF JOB TITLES

PLAN FOR PROGRAM ORGANIZATION				DERIVATION OF LEARNING CONTENT			
I	II	III	IV	V	VI	VII	VIII
DIVISION (PROGRAMS)	CATEGORY (CURRICULA)	SUBCATEGORY (COURSES)	JOB TITLE	TASK	SUBCATEGORY CORE	CATEGORY CORE	DIVISION CORE
AUTO, LIGHT DUTY, & MEDIUM DUTY VEHICLES REPAIR	HEAVY LINE REPAIR	ENGINE SYSTEM	Engine overhaul specialist	List of tasks	Tasks common to ENGINE SYSTEM	Tasks common to HEAVY LINE REPAIR	Tasks common to AUTO, LIGHT DUTY, & MEDIUM DUTY VEHICLES REPAIR
			Short block specialist	List of tasks			
			Valve train specialist	List of tasks			
			Automotive machinist	List of tasks			
			Engine machinist	List of tasks			
			Heavy line mechanic	List of tasks			
			Lubrication system specialist	List of tasks			
		DRIVE TRAIN SYSTEM	Overdrive specialist	List of tasks	Tasks common to DRIVE TRAIN SYSTEM		
			Differential specialist	List of tasks			
			Manual transmission specialist	List of tasks			
			Automatic transmission spec.	List of tasks			
			Clutch specialist	List of tasks			
			Transaxle specialist	List of tasks			
			Drive shaft repair specialist	List of tasks			
	LIGHT LINE REPAIR	BRAKE SYSTEM	Hydraulic brake specialist	List of tasks	Tasks common to BRAKE SYSTEM	Tasks common to LIGHT LINE REPAIR	
			Brake shoe liner	List of tasks			
			Pneumatic air brake specialist	List of tasks			
			Brake machinist	List of tasks			
			Light line mechanic	List of tasks			

AUTO, LIGHT DUTY, & MEDIUM DUTY VEHICLES REPAIR	LIGHT LINE REPAIR	FRONT END SYSTEM	Front end specialist	List of tasks	Tasks common to FRONT END SYSTEM	Tasks common to LIGHT LINE REPAIR	Tasks common to AUTO, LIGHT DUTY, & MEDIUM DUTY VEHICLES REPAIR
			Wheel bearings, tire & wheel balancing specialist	List of tasks			
			Steering & suspension specialist	List of tasks			
		ELECTRICAL SYSTEM	Engine diagnostic specialist	List of tasks	Tasks common to ELECTRICAL SYSTEM		
			Engine tune-up specialist	List of tasks			
			Battery-generator-starter-alternator-regulator specialist	List of tasks			
			Elec'l. wiring harness& diagram s.	List of tasks			
			Power accessory specialist	List of tasks			
		HEATING & AIR CONDITIONING SYSTEM	Air conditioning service person	List of tasks	Tasks common to HEATING & AIR CONDITIONING SYSTEM		
			Air conditioning compressor overhauler	List of tasks			
			Climate control specialist	List of tasks			
			Air conditioning diagnostic sp.	List of tasks			
			Air conditioning installer	List of tasks			
			Heater diagnostic specialist	List of tasks			
			Heater core repair person	List of tasks			
		COOLING SYSTEM	Cooling system specialist	List of tasks	Tasks common to COOLING		
			Core repair person	List of tasks			
		FUEL EXHAUST SYSTEM	Emission control specialist	List of tasks	Tasks common to FUEL EXHAUST SYSTEM		
			Exhaust system installer	List of tasks			
			Fuel and air system specialist	List of tasks			
	SUPPORTIVE OCCUPATIONS	SUPERVISORY	Shop foreman	List of tasks	Tasks common to SUPERVISORY	Tasks common to SUPPORTIVE OCCUPATIONS	
			Service manager	List of tasks			
			Quality control inspector	List of tasks			
			Estimator	List of tasks			
			Parts manager	List of tasks			

I	II	III	IV	V	VI	VII	VIII
DIVISION (PROGRAMS)	CATEGORY (CURRICULA)	SUBCATEGORY (COURSES)	JOB TITLE	TASK	SUBCATEGORY CORE	CATEGORY CORE	DIVISION CORE
AUTO, LIGHT DUTY, & MEDIUM DUTY VEHICLES REPAIR	SUPPORTIVE OCCUPATIONS	LOGISTICS & MAINTENANCE	Lubrication person	List of tasks	Tasks common to LOGISTICS & MAINTENANCE	Tasks common to SUPPORTIVE OCCUPATIONS	Tasks common to AUTO, LIGHT DUTY, & MEDIUM DUTY VEHICLES
			Dispatcher	List of tasks			
			Car jockey or clean-up	List of tasks			
			Service writer	List of tasks			
			Parts & accessories salesperson	List of tasks			
			Service salesperson	List of tasks			
			Parts person	List of tasks			
HEAVY DUTY VEHICLES REPAIR	HEAVY LINE REPAIR	ENGINE SYSTEM	Engine overhaul specialist	List of tasks	Tasks common to ENGINE SYSTEM	Tasks common to HEAVY LINE REPAIR	Tasks common to HEAVY DUTY VEHICLES REPAIR
			Short block specialist	List of tasks			
			Valve train specialist	List of tasks			
			Automotive mechanic	List of tasks			
			Engine machinist	List of tasks			
			Heavy line mechanic	List of tasks			
		DRIVE TRAIN SYSTEM	Overdrive specialist	List of tasks	Tasks common to DRIVE TRAIN SYSTEM		
			Manual transmission specialist	List of tasks			
			Automatic transmission spec.	List of tasks			
			Clutch specialist	List of tasks			
			Drive shaft repair person	List of tasks			
	LIGHT LINE REPAIR	BRAKE SYSTEM	Light line mechanic	List of tasks	Tasks common to BRAKE SYSTEM	Tasks common to LIGHT LINE REPAIR	
			Hydraulic brake specialist	List of tasks			
			Pneumatic air brake specialist	List of tasks			
			Brake shoe reliner	List of tasks			
		FRONT END SYSTEM	Front end specialist	List of tasks	Tasks common to FRONT END SYSTEM		
			Wheel bearings, tire & wh. balancing	List of tasks			
			Steering & suspension specialist	List of tasks			

APPENDIX A

HEAVY DUTY VEHICLES REPAIR	LIGHT LINE REPAIR	ELECTRICAL SYSTEM	Battery-generator-starter-alternator-regulator specialist	List of tasks	Tasks common to ELECTRICAL SYSTEM	Tasks common to LIGHT LINE REPAIR	Tasks common to HEAVY DUTY VEHICLES REPAIR
			Elec'l. wiring harness & diagram sp.	List of tasks			
			Power accessory specialist	List of tasks			
			Air conditioning service person	List of tasks			
		HEATING & AIR CONDITIONING SYSTEM	Air cond. compressor overhauler	List of tasks	Tasks common to HEATING & AIR CONDITIONING SYSTEM		
			Climate control specialist	List of tasks			
			Air conditioning diagnostic sp.	List of tasks			
			Air conditioning installer	List of tasks			
			Heater diagnostic specialist	List of tasks			
			Heater core repair person	List of tasks			
		COOLING SYSTEM	Cooling system service person	List of tasks	Tasks common to COOLING SYSTEM		
			Cooling & lubrication system sp.	List of tasks			
			Lubrication person	List of tasks			
		FUEL, EXHAUST, & LUBRICATION SYSTEM	Engine tune-up specialist	List of tasks	Tasks common to FUEL, EXHAUST, & LUBRICATION SYSTEM		
			Exhaust system installer	List of tasks			
			Fuel injection specialist	List of tasks			
			Pump and injector specialist	List of tasks			
			Supercharging and turbocharging specialist	List of tasks			
			Governor specialist	List of tasks			
			Fuel and air system specialist	List of tasks			
	SUPPORTIVE OCCUPATIONS	SUPERVISORY	Shop foreman	List of tasks	Tasks common to SUPERVISORY	Tasks common to SUPPORTIVE OCCUPATIONS	
			Service manager	List of tasks			
			Quality control inspector	List of tasks			
			Parts manager	List of tasks			
		LOGISTICS & MAINTENANCE	Car jockey or clean-up	List of tasks	Tasks common to LOGISTICS & MAINTENANCE		
			Service writer	List of tasks			
			Parts & accessories salesperson	List of tasks			

I	II	III	IV	V	VI	VII	VIII
DIVISION (PROGRAMS)	CATEGORY (CURRICULA)	SUBCATEGORY (COURSES)	JOB TITLE	TASK	SUBCATEGORY CORE	CATEGORY CORE	DIVISION CORE
HEAVY DUTY VEHICLES REPAIR	SUPPORTIVE OCCUPATIONS	LOGISTICS & MAINTENANCE	Service salesperson	List of tasks	Tasks common to LOGISTICS & MAINTENANCE	Tasks common to SUPPORTIVE	Tasks common to HEAVY DUTY VEHICLES
			Estimating person	List of tasks			
			Parts person	List of tasks			
TRUCK & AUTO BODY REPAIR	BODY & FRAME	FRAME	Frame & panel straightener	List of tasks	Tasks common to FRAME	Tasks common to BODY & FRAME	Tasks common to TRUCK & AUTO BODY REPAIR
			Welder	List of tasks			
		METAL	Sheet metal straightener & cutter	List of tasks	Tasks common to METAL		
			Dent filling specialist	List of tasks			
			Fiber glass specialist	List of tasks			
	TRIM & FABRICS	WEATHER-STRIPPING & FABRICS	Auto body maintenance person	List of tasks	Tasks common to WEATHER-STRIPPING & FABRICS	Tasks common to TRIM & FABRICS	
			Upholstery & weatherstrip spec.	List of tasks			
			Convertible top, fabric roofs, woodgrain specialist	List of tasks			
		GLASS & TRIM	Hardware specialist	List of tasks	Tasks common to GLASS & TRIM		
			Glass installer	List of tasks			
			Trim specialist	List of tasks			
	PREPARATION & PAINTING	BODY PREPARATION	Metal preparer	List of tasks	Tasks common to BODY PREPAR.	Tasks common to PREPAR. & PAINTING	
			Sanding specialist	List of tasks			
		PAINTING	Paint matching specialist	List of tasks	Tasks common to PAINTING		
			Masking person	List of tasks			
			Painter	List of tasks			
	SUPPORTIVE OCCUPATIONS	SUPERVISORY	Estimator	List of tasks	Tasks common to SUPERVISORY	Tasks common to SUPPORTIVE OCCUPATIONS	
			Parts manager	List of tasks			
			Shop foreman	List of tasks			
		LOGISTICS	Parts person	List of tasks	Tasks common to LOGISTICS		
			Clean-up person	List of tasks			

I	II	III	IV	V	VI
DIVISION/CATEGORY (PROGRAMS/CURRICULA)	SUBCATEGORY (COURSES)	JOB TITLE	TASK	SUBCATEGORY CORE	DIVISION/CATEGORY CORE
SMALL ENGINES REPAIR	MARINE	OMC & Mercury cruiser mechanic	List of tasks	Tasks common to MARINE	Tasks common to SMALL ENGINES REPAIR
		Evinrude & Johnson outboard mech.	List of tasks		
		Mercury outboard mechanic	List of tasks		
		Chrysler outboard mechanic	List of tasks		
		Rigger	List of tasks		
		Glass, wood, & fiber glass spec.	List of tasks		
		Boat mechanic (jets)	List of tasks		
	MOTORCYCLE	Honda motorcycle mechanic	List of tasks	Tasks common to MOTORCYCLE	
		Kawasaki motorcycle mechanic	List of tasks		
		Yamaha motorcycle mechanic	List of tasks		
		Indian motorcycle mechanic	List of tasks		
		Harley-Davidson motorcycle mech.	List of tasks		
		Suzuki motorcycle mechanic	List of tasks		
		Triumph motorcycle mechanic	List of tasks		
		BSA motorcycle mechanic	List of tasks		
	UTILITY IMPLEMENTS & ALL-TERRAIN VEHICLES	Small engine mechanic (gas)	List of tasks	Tasks common to UTILITY IMPLEMENTS & ALL-TERRAIN VEHICLES	
	SUPPORTIVE OCCUPATIONS	Parts person	List of tasks	Tasks common to SUPPORTIVE OCCUPATIONS	
		Service manager	List of tasks		
		Shop foreman	List of tasks		
		Salesperson	List of tasks		
		Parts manager	List of tasks		

APPENDIX A

APPENDIX B

MULTI-OCCUPATIONAL PBVE PROGRAM WORKSHEET

PROGRAM MANAGEMENT PLANNING GUIDE

Step 1: For the entire program, state the occupational category(ies) for which students will receive training.

Step 2: For each occupational category specified above, identify the courses in which students will enroll.

Step 3: For each course identified above (Step 2), specify the job titles for which students will be prepared.

Step 4: Analyze each task to be taught for each job title to determine cognitive and psychomotor skills to be learned.

Step 5: State recommended prerequisite related courses for each course listed in Step 2 above.

Step 6: For each job title in each course, indicate the expected average training time assuming no previous training.

Step 7: State the rationale and the points in the program, category(ies) and courses at which students may enter and exit.

Step 8: For each training level (category and/or course) indicate how students will be assigned to the appropriate category or course, how they will be assessed (pre- and post-assessment), how they will be advanced horizontally and vertically within or between courses or categories, and how they will receive credit or certification.

Step 9: State suggested maximum enrollment for each course.

Step 10: State staff requirements by category/course.

Step 11: After completing the curriculum management plan, specify the equipment needs for each course.

APPENDIX B *continued*

1. Occupational category(ies)

   a. _____
   b. _____
   c. _____

2. Courses

Category A	*Category B*	*Category C*
1. _____	1. _____	1. _____
2. _____	2. _____	2. _____
3. _____	3. _____	3. _____

3. Job title(s)

Course A-1	*Course A-2*	*Course A-3*
1. _____	1. _____	1. _____
2. _____	2. _____	2. _____
3. _____	3. _____	3. _____
4. _____	4. _____	4. _____

Course B-1	*Course B-2*	*Course B-3*
1. _____	1. _____	1. _____
2. _____	2. _____	2. _____
3. _____	3. _____	3. _____
4. _____	4. _____	4. _____

Course C-1	*Course C-2*	*Course C-3*
1. _____	1. _____	1. _____
2. _____	2. _____	2. _____
3. _____	3. _____	3. _____
4. _____	4. _____	4. _____

4. Task analysis (by job title)

Cognitive skills	*Psychomotor skills*
_____	_____

APPENDIX B *continued*

5. Related courses

Course	*Prerequisites*
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____

6. Expected average training time

Course 1

Job title	*Average training time*
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____

Course 2

Job title	*Average training time*
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____

Course 3

Job title	*Average training time*
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____

Course 4

Job title	*Average training time*
1. _____	1. _____
2. _____	2. _____
3. _____	3. _____
4. _____	4. _____

7. Entry-exit points

Course entry-exit level	*Rationale*
Course 1:	_____
Course 2:	_____
Course 3:	_____

APPENDIX B *continued*

8. Assignment, assessment, advancement, and crediting or certification plans

_____

_____

_____

_____

9. Suggested maximum enrollment

	Course	*Suggested maximum enrollment*
1.	_____	
2.	_____	
3.	_____	
4.	_____	

10. Staff requirements

	Category/course		*Staff requirements*
1.	_____	1.	_____
2.	_____	2.	_____
3.	_____	3.	_____
4.	_____	4.	_____

11. Equipment needs

	Course		*Needs*
1.	_____	1.	_____
		2.	_____
		3.	_____
		4.	_____
		5.	_____

APPENDIX C : TASK ANALYSIS GUIDE AND CONTENT LIMITS IDENTIFICATION WORKSHEET

TASK ANALYSIS GUIDE

I. **Task statement:**

OVERHAUL ALTERNATOR

II. **Task performance cues:**

Charging system diagnosis indicates defective alternator.

III. **Task performance procedures:**

A. When a decision must be made, indicate alternatives as *yes - no* answers to questions.
B. List performance steps by most frequently occurring sequence.

SUBTASK NUMBERS	*TASK ELEMENTS*	*DECISIONS* yes	no	*Go to step*	*LEARNING CONTENT*	*TOOLS, AIDS, REFERENCES*
1	1. Visually inspect charging system			2		
2	2. Disconnect negative battery cable			3		
	3. Remove alternator			4		
	4. Disassemble alternator and clean parts			5		
	5. Do bearings in front & rear housing need replaced?	17	6			
	6. Do brushes need replaced?	18	7			
3	7. Does rotor pass continuity and ground test? . . .	8	19			
	8. Does stator pass continuity and ground test? . . .	9	20			
	9. Do diodes pass continuity test?	10	21			
	10. Does alternator have integral regulator?	22	11			
	11. Does alternator have diode trio?	23	12			

3	12. Reassemble alternator			13		
	13. Install alternator			14		
	14. Connect test equipment			15		
4	15. Is alternator output to manufacturer's specification?	16	24			
	16. Disconnect test equipment & check all connections			EOT		
	17. Press out old bearings & press in new bearings			6		
	18. Replace brushes			7		
	19. Install new rotor			8		
3	20. Repair or replace stator			9		
	21. Replace defective diodes			10		
	22. Does integral regulator meet manuf'r's specification?	11	25			
	23. Does diode trio pass continuity test?	12	26			
5	24. Rediagnose charging system & correct problem			EOT		
3	25. Replace integral regulator			11		
	26. Replace diode trio			12		

CONTENT LIMITS IDENTIFICATION WORKSHEET--OVERHAUL ALTERNATOR

Cell 2:1 [a]	Cell 2:2 [b]	Cell 2:3 [c]	Cell 2:4 [d]	Cell 2:5 [e]	Cell 2:6 [f]
ST#1: Visually inspect charging system. TAG element: 1 Content limits: See task: Diagnose charging system malfunction ST#1			ST#1: Visually inspect charging system. TAG element: 1 Content limits: See task: Diagnose charging system malfunction ST#1		

continued on next pages

CONTENT LIMITS IDENTIFICATION WORKSHEET--OVERHAUL ALTERNATOR *continued*

Cell 2:1 [a]	*Cell 2:2* [b]	*Cell 2:3* [c]	*Cell 2:4* [d]	*Cell 2:5* [e]	*Cell 2:6* [f]
NOTE: All learning content in this column is generalizable to all tasks in the domain. The tasks are: 1.Diagnose charging system malfunction 2.Overhaul alternator 3.Adjust regulator 4.Adjust generator 5.Replace alternator 6.Replace generator 7.Replace ammeter gauge 8.Replace regulator 9.Replace battery 10.Replace fusable link	ST#2: Remove alternator TAG elements:2-3 Content limits: See task #5, Cell 5:2 ST#3: Repair and reinstall alternator TAG elements:4-13 17-23, 25-26 Content limits: 1.Alternator construction 2.Tools & equipment 3.Rules for disassembling alternator 4.Diodes 5.Rotor 6.Stator 7.Integral regulation 8.Bearings 9.Brushes 10.Trio-diode	*NOTE: Learning content in this cell is specific to a given task. E.g., Cell 3 for Adjust Regulator, Task 3, would contain specific information about Delco, Auto Lite, or Essex regulators. The team decided that most alternators were sufficiently alike to permit transfer of knowledge among them. Therefore, Cell 2 contains all the learning content pertaining to alternators.*	*NOTE: All learning content in this column is generalizable to all tasks in the domain. The tasks are:* 1.Diagnose charging system malfunction 2.Overhaul alternator 3.Adjust regulator 4.Adjust generator 5.Replace alternator 6.Replace generator 7.Replace ammeter gauge 8.Replace regulator 9.Replace battery 10.Replace fusable link	ST#2: Remove alternator TAG elements:2-3 Content limits: See task #5, Cell 5:2 ST#3: Repair and reinstall alternator TAG elements:4-13 17-23, 25-26 Content limits: 1.Perform: diode test rotor test stator test integral regulation test trio-diode test bench test 2.Repair: fan stator 3.Replace: bearings brushes	*NOTE: Learning content in this cell is specific to a given task. E.g., Cell 3 for Adjust Regulator, Task 3, would contain specific information about Delco, Auto Lite, or Essex regulators. The team decided that most alternators were sufficiently alike to permit transfer of knowledge among them. Therefore, Cell 2 contains all the learning content pertaining to alternators.*

11. Replace ignition switch *The learning content is listed on the Learning Content Identification Sheet for Task 1.*	11. Fan 12. Rules for testing the above components 13. Bench test 14. Rules for assembling alternator 15. Rules for repairing/ replacing above components		11. Replace ignition switch *The learning content is listed on the Learning Content Identification Sheet for Task 1.*		
ST#4: Check charging system output TAG elements: 14-16 Content limits: See task: Diagnose charging system malfunction ST#3			ST#4: Check charging system output TAG elements: 14-16 Content limits: See task: Diagnose charging system malfunction ST#3		
ST#5: Diagnose charging system TAG element: 24 Content limits: See task #1, all cells			ST#5: Diagnose charging system TAG element: 24 Content limits: See task #1, all cells		

NOTE: The cells in this worksheet represent the following categories of knowledges and skills:

[a] Cognitive, generalizable across all tasks in a domain.
[b] Cognitive, specific to tasks in a given class.
[c] Cognitive, specific to a given task.
[d] Psychomotor, generalizable across all tasks in a domain.
[e] Psychomotor, generalizable to tasks in a given class.
[f] Psychomotor, specific to a given task.

APPENDIX D

ESTIMATED EQUIPMENT LISTS

ENGINE TUNE-UP SPECIALIST

Quantity	Item	Cost
1	Sun 940' scope (without infra red unit)	$ 2937
1	504 distributor tester & VAT 28	have
1	640 manometer	have
1	DAP distributor pulse amplifier	57
1	Sun spec. cards (1976)	12
1	Sun tester bulletins	have
1 each	Service manuals	150
3	Compression testers (1 long reach, 1 short)	25
1	Fuel pump tester	have
2	Timing lights	have
4	5/8" spark plug sockets	10
2	13/16" spark plug sockets, 3/8 drive	10
3	Flex handle 3/8" drive ratchet	50
3 each length	Extension for 3/8" drive ratchet (3"-6"-18")	40
3	5/8" flex spark plug sockets	18
1 each	Sockets (standard length--6 point) (1 each--1/4", 1/2", 9/16", 5/8", 11/16", 3/4")	11
1 each	Sockets (standard length--12 point) (1 each--1/4", 1/2", 9/16", 5/8", 11/16", 2 each--3/4")	13
2	Speeder for 3/8" drive	7
4	Flex sockets for 3/8" drive (4-7/16", 4-1/2", 4-9/16", 4-5/8")	47
1 set	Metric tools (for tune-up)	150
1 set	English allen wrenches (size .028 to 3/4")	22
1 set	Metric allen wrenches (2mm-19mm)	20
1	Torque wrench (snap or click type)	52
1	Ignition wrench set	24
1	Combination wrench set (6 and 12 point)	271
2	Ignition pliers	15
4	Standard screwdriver sets	57
4	Standard phillip screwdriver sets	60
5	Ignition screw starters	6
3	Pry bars	30
8	Carburetor rebuilding stands	32

APPENDIX D *continued*

1		Carburetor cleaning tank	$ 60
2		Needle nose pliers	have
3		Battery clamp puller	8
1		Battery post cleaners	have
4		Fender covers	16
2		Spark plug gap gauges	2
3		Dist. adjuster screwdrivers for GM cars	10
3		Dist. and coil nut wrenches	2
2		Hinged magnets	4
1		Portable vacuum gauge	45
1		Portable volt and ohmmeter	50
3		13/16" flex spark plug sockets	18
1		Infra red unit	895
1		Amp inductive indicator	6
5		Drop lights	14
6		Pressure blow guns	6
2		Distributor cap brushes	3
3		Fuel pump sockets	9
1	set	Line wrenches	10
1		Fire extinguisher	30
5	each	Carburetors (1, 2, and 4 barrel)	180
4		Live engines with instrumentation on stand	250
TOTAL			$5774

ENGINE OVERHAUL SPECIALIST

1		Four cylinder engine	have
1		Engine work stand	187
1		Cleaning tank	have
1		1/4" drive socket set	50
2		3/8" drive sockets (regular and deep)	80
2	sets	3/8" drive extensions	15
2		3/8" drive universal joints	7
3		3/8" breaker bars	18
3		3/8" T-handles	10
3		3/8" standard ratchets	50
1	set	3/8" drive weatherhead sockets	42
1	set	3/8" drive double square sockets	15
1	complete set	1/2" drive sockets (regular and deep) (6 point and 12 point)	62
1	set	1/2" drive weatherhead sockets	16
1	complete set	Double square sockets (1/2"drive)	13
3		1/2" drive extensions (2-4" and 1-24")	18
2		1/2" drive T-handles	9
3		3/8" drive speeder handles	18

APPENDIX D *continued*

Quantity	Item	Cost
2	Pry bars	$ 9
1	Complete allen wrench set	22
2	Torque wrenches	104
1 set	Complete set of offset *Boxockets* (5/8")	20
1 set	6 point ratcheting *Boxockets*	56
1 set	12 point ratcheting *Boxockets*	56
2 sets	Combination wrench sets	20
4	Needle nose pliers	22
3	Standard screwdriver sets	56
3	Phillips screwdriver sets	60
4	Screw starters with magnets	6
2	Brass hammer	29
1	Punch and chisel set	30
3	Scrapers	10
1	Steel stamping set	18
1	3/8" drive air ratchet	171
1	1/2" drive air ratchet	have
1	Tube cutting and double flaring set	25
1	Tube bender	8
1	Drill press	300
1 each	Electric drill 3/8" and 1/2"	150
3	Carbon brushers	6
1	Depth micrometers (range 0"-6")	56
1	Micrometer (4"-5" and 5"-6")	84
2	Telescoping gauge sets	40
1	Tap and die set	264
1	Cam bearing drive set	100
1	Vacuum gauge	45
1	Compression gauge	55
3	Oil cans	6
1	Engine sling	21
2	Air pressure guns	have
1	Precision straight edge	16
2	Lifter removing tools	13
2 boxes	Plastic gauges	16
1	Boring machine	300
2	Flexible shaft mechanical fingers	4
3	Hinged magnetic pick-up tools	12
4	Ring compressors	12
3	Piston ring spreaders	9
3	Ring groove cleaners	19
3	Ridge reamers	45
3	Cylinder hones	148
3	Valve guide cleaning tools	6
2	Valve guide knurler sets	67
3	Valve laping tool and compounds	20
2	Valve spring removing tools	20

APPENDIX D *continued*

1	Valve grinding machine	have
1 set ea.	Valve grinding stones and valve seat grinding stones	300
1	Valve spring tester	40
1	Valve lifter leak down tester	70
1	Dial gauge for inside cylinder	95
TOTAL		$3671

VALVE TRAIN SPECIALIST

1	Valve grinding machine	have
4	Valve spring compressors	40
2	Valve guide knurler sets	67
3	Valve guide cleaners	6
4	Feeler gauges	9
2 sets	Valve adjustment wrenches	26
4	Scrapers	12
2	Electric drills 3/8"	90
4	Wire cleaning brushes	24
5	Cylinder head work stands	100
3	Compression gauges	55
1	Valve seat grinding set	have
4	Air blow guns	7
1	Cleaning tank	have
2	File sets	20
4	Pry bars	22
4	Plastic head hammers	37
2	Rubber mallets	24
1	Hydraulic press	2178
2	Torque wrenches	104
4 cans	Valve grind compound	10
4 cans	Gasket sealer	10
4	3/8" drive ratchets	72
4	1/2" drive extensions	23
4 each	3/8" drive sockets	24
4 each	1/2" drive sockets	48
2 cans	Putty	5
1 set	Valve port grinding wheels	100
1	Tap and die set	264
1	Valve lifter leak down tester	70
1	Cam bearing installing tool	100
1	Torch set	have
4	Standard tip screwdriver sets	84
2	Sets of allen wrenches	44
2 rolls	Emery cloth	32
3 cases	Engine oil	30
1	Number stamp set	18

APPENDIX D *continued*

Quantity	*Item*	*Cost*
-	Punch and chisel set	have
4	Soft face two point hammers	9
4	Ball peen hammers	5
5 rolls	Masking tape	15
10 cans	Paint	20
1	Valve spring tester	40
1 set	Factory manuals	80
4	Fender covers	16
5 cans	Magno flex spray	25
1	Dial indicator	have
1	Dial gauge for testing valve seat accuracy	80
1	Valve guide removing and installing tool	100
1	Drill press	300
TOTAL		$4445

BATTERY-GENERATOR-STARTER-ALTERNATOR-REGULATOR SPECIALIST

1	VAT 28 sun tester	have
1	Sun 620 alternator and regulator tester	have
8	Batteries	175
1	Battery charger	360
1	Complete 1/4" drive socket set	150
2	Complete allen wrench sets	44
4 each	3/8" drive ratchet and extensions	108
4 each	3/8" drive socket sets	84
4 each	Ignition files	8
1	Two speed soldering gun	have
4 rolls	Solder	5
4	Brass covers for bench vise	20
1	Ampmeter	50
1	Volt meter	60
4 sets	Adjusting tools for regulator	40
1	Dial indicator	have
4	V-blocks	60
1	Ohmmeter tester	50
1	Small puller set	30
1	Rectifier diode tester	125
1	Alternator diode remover and installer	52
1	Amp inductive indicator	19
4	Universal pliers	16
4	Needle nose pliers	21
1	Wire stripper set with wire lead ends	31
4	Side cuts	have
4	Two pound hammers with plastic and rubber tips	42
2 sets	Shock-resistant nut drivers	62

APPENDIX D *continued*

4	Pry bars	$ 22
6 rolls	Electric wire	25
4	Standard screwdriver sets	84
4	Phillips screwdriver sets	90
4	Functional work boards for different cars	300
Assortment	Extra fuses	10
Assortment	Extra electric parts (new and used)	400
TOTAL		$2543

HYDRAULIC BRAKE SPECIALIST

2	Work stations with car brake systems on them	$400
1	Ammco brake lathe	have
1	Twin cutter tool with acc.	175
1	Grinding attachment for rotor	278
1	Cross feed extension	48
1	Tool kit for non-vented rotors	49
1	Brake disc. micrometer	49
1	Checking gauge for brake drum micrometers	19
2	Caliper piston pliers	18
2	Caliper seal installers	14
4	Brake cylinder hones	67
4	Disc brake caliper hones	56
1	Power brake bleeder with adapters	have
2 cans	Wheel bearing grease	10
4 each	Brake adjusting tools	156
4	Brake return spring tools	15
1	Dial indicator	have
2	Torque wrenches	7
4	Brass drive bars	12
1	Punch and chisel set	10
4 types	Abrasive belts for brake shoe grinder	111
1	Complete allen wrench set	22
8 cans	Penetrating oil	20
3 boxes	Cotter keys	10
2 rolls	Machine wire	5
4	3/8" drive ratchets and extensions	108
2	1/2" drive ratchets and extentions	have
4	1/2" drive breaker bars	30
1	Line wrench set (1/4"-5/8")	have
3 each	3/8" drive sockets (standard length)	28
3 each	1/2" drive sockets (standard length)	35
4	Adjustable wrenches	16
3	Side cuts	have
3	Large channel locks	42
3	Box wrenches	113
4	Rubber hoses (1' long)	3

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APPENDIX D *continued*

Quantity	Item	Cost
3	Plastic bottles	$ 6
3	Work stools	47
3	Dust boot installers	12
3	Disc. brake pad spreaders	36
1	Facing and grinding set	82
1	1/2" drive impact wrench	have
TOTAL		$2169

LIGHT LINE MECHANIC

1	1/2" drive air impact with sockets	have
1 each	Wheel balancer (both types)	2000
1	Wheel weights and case	127
3	Wheel weight hammers	27
Assortment	Tap weights	75
2 gal.	Thinner	7
1 set	Muffler-tail pipe expander	38
2 each	Shock absorber sockets	30
4 each	3/8" drive ratchets and extensions	108
4 each	1/2" drive ratchets and extensions	65
4	3/8" drive universal joints	22
4	1/2" drive universal joints	16
1 set	3/8" drive weatherhead fittings	42
4 each	Brake adjusting tools	155
3	Lock ring pliers	20
1	Caliper piston pliers	9
1	Caliper seal installer	7
4	Brake cylinder hones	48
4	Disc brake caliper hones	56
2	Torque wrenches	have
4	Brass drive bars	12
1	Punch and chisel set	have
1	Complete allen wrench set	22
4	3/8" drive breaker bars	24
4	1/2" drive breaker bars	33
2	Line wrench sets	64
3	Side cuts	10
4	Channel lock pliers	14
2	Box wrench sets	224
2	Combination wrench sets	271
4 each	Set of brake tools	153
1	Interchangeable puller set	have
3 each	Complete sets of 3/8" drive sockets	50
2 each	Complete sets of 1/2" drive sockets	120
3 each	Ratcheting Boxockets	120

APPENDIX D *continued*

4 each	Drop lights	36
TOTAL		$4023

AUTOMATIC TRANSMISSION SPECIALIST

2	A.T. oil pressure gauges	$137
3	A.T. work stands	559
1 set ea.	Special factory tools (from Ford, GM, AMC, and Chrysler)	2500
4	Pressure blow guns	10
1	Cleaning tank	have
2	Line fitting wrench sets	66
2	Transmission jacks	642
1 set ea.	Band adjusting tools (from Ford, GM, AMC, and Chysler)	250
4	Standard screwdriver sets	84
4	Scrapers	15
4	Phillips screwdriver sets	90
4	Two-pound plastic hammers	have
4	Rubber hammers	24
4	Brass hammers	43
4	Needle nose pliers	22
4 sets	Feeler gauges	19
1	Punch and chisel set	have
4	Ball peen hammers	21
4	Brass drive bars	24
4	Capé chisels	20
1	Dial indicator	have
2 each	Torque wrenches	72
3	Snap ring pliers	20
1	High pressure air gauge	have
4	Center support locating tools	19
4	Sea clamps	12
4	3/8" drive ratchets and extensions	108
4	1/2" drive ratchets and extensions	have
4	3/8" drive speeder handles	22
4 each	3/8" drive flex sockets	48
4	3/8" drive universal joints	21
4	1/2" drive universal joinst	16
4	Short adaptors	10
4 each	3/8" drive sockets	69
4 each	1/2" drive sockets	54
1	Mircometer set	have
TOTAL		$4997

GLOSSARY

Commonly Used Definitions of Terms Used in PBVE Planning

Affective behavior--those behaviors which result from personal opinions, attitudes, feelings, beliefs, and values.

Cognitive behavior--those mental behaviors which result from acquisition and use of knowledge.

Competency--performance of tasks at a specified level under designated conditions.

Criterion-referenced measure--an evaluation component to assess the attainment of a performance objective.

Dictionary of Occupational Titles (DOT)--Department of Labor publication listing job titles and job descriptions.

Domain referenced test (DRT)--a test comprised of a random or stratified random sample of items representing a defined set, class, or universe of tasks (domain).

Duty--a cluster of related tasks.

Job--tasks performed by an individual to achieve specific occupation requirements.

Job title--titles found in the Dictionary of Occupational Titles and those determined by job title analysis in Indiana.

Job title analysis--a process which verifies jobs and tasks.

Occupational analysis--a process of identifying employment needs and trends.

Occupational domain--a cluster of related job titles.

Occupational matrix--a systematic organization of occupational units which identifies tasks that are generalizable and transferable.

Performance based vocational education (PBVE) programs--programs based on job research where course content is identified through task analysis, instructional content is identified in terms of performance objectives, and student progress is assessed through use of criterion-referenced measures.

Performance guide--a suggested learning sequence to achieve a performance objective.

Performance objective--a statement in precise, measurable terms of a task-related behavior to be exhibited by a learner under specified conditions.

Psychomotor behavior--those physical behaviors which result from a mental process.

Task--the smallest unit of work that constitutes a sequential set of related behaviors for the completion of a job.

Task analysis--the process of reducing a task into its affective, cognitive, and psychomotor behavioral components.

Vocational curriculum--program content, instructional materials, and media organized to prepare students for one or more occupations.

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